Western intellectual history, it was the accepted way of understanding the organic world. Christianized Europe translated Aristotle's concept of archetypes into the more theological concept of patterns used by God in creation--"ideas in the mind of God," as they phrased it. In its Christian form, the typological model survived essentially intact throughout the development of taxonomy and zoology as scientific disciplines.

Then in the 1800's with the rise of evolutionary theory, the typological model came under attack. Darwin argued that taxonomic groupings exist only in the mind of the beholder. All that exists objectively are individuals; the living world is a continuous chain of individual organisms shifting gradually from one body plan to the next. Similarities, Darwin said, indicate not an archetypical pattern but a common ancestor. All birds share a set of characteristics because they all descended from a generalized bird that evolved in the distant past. Indeed, the existence of similarities became the single strongest argument for the validity of evolution.

true?

Today, with the decline of Darwinism, the debate over typology is being revived. Both creationists and certain anti-Darwinian evolutionists have argued that the typological model fits the living world better than Darwin's chain of individuals related by descent. Let's trace the lines of this debate and see its relevance for biology today. Again, our strategy will be first to lay out the basic facts uncovered by the science of

Have we explained "the decline of Darwinism" in light of new textbook emph?

yes?

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taxonomy, and then to see how evolutionists and creationists account for these facts.

Mary Had a Little Lamb (<u>Ovis Aries</u>)

The fact that we can classify living things at all means that we perceive degrees of similarity among them. A dog is more like a wolf than it is like a fox; as a result, the dog and the wolf are classified in the same genus (**Canis**) but the fox is classified in a different genus. Yet a dog is more like a fox than it is like a cat; so they are classified in the same family (Canidae) but the cat is classified in a different family. Yet a dog is more like a cat than it is like a horse; they are placed in the same order (Carnivore), but the dog and the horse are placed in different orders. Still, a dog is more like a horse than it is like a fish; therefore, they share the same class (Mammal) but the fish is in a different class. Yet a dog is more like a fish than it is like a worm; both dog and fish belong to a single phylum (vertebrates) but the worm belongs to a different phylum. The dog has more in common with a worm, however, than it has with an oak tree; therefore, they are in the same kingdom (animals) and the tree is in a different kingdom (plants).

This may all sound rather simple, but the its simplicity is deceptive. Once we proceed beyond the rather obvious similarities--~~all~~ birds have feathers, ~~all~~ vertebrates have backbones--it is not always so easy to decide how to group

(cordata-notochord)

organisms. Similarities appear in a patchwork pattern that makes classification difficult.

Fact #1. Similarities are sometimes contradictory.

Consider the marsupials--mammals that nurture their newborn progeny in a pouch on the mother's belly (in contrast to placental mammals, such as humans). Marsupials and placental mammals are sometimes strikingly similar. For instance, in skeletal structure, the Canadian wolf and the now-extinct Tasmanian wolf are nearly indistinguishable. If found as fossils, they would surely be counted as members of the same species. The behavior and life-style of the Tasmanian wolf was likewise quite similar to that of the North American wolf. Despite these close parallels, because the two animals differ in their mode of reproduction, the standard taxonomic approach is to classify them in widely different categories--the Canadian wolf with the dog and the Tasmanian wolf with the kangaroo.

use same wolves as main text

✓

Besides wolves, there are also marsupial look-alikes to cats, squirrels, ground hogs, anteaters, moles, and mice. Marsupials raise an interesting question for taxonomy: If similarity is the basis for classification, what shall we do when similarities conflict? The marsupial wolf is strikingly similar to the placental wolf in most features, yet it is like the kangaroo in one significant feature. Upon which similarity do we build our classification scheme?

How main text ap? (wolf?)

Fact #2. It may be difficult to distinguish similarity in function from similarity in structure.

A bird's wing and an insect's wing are both used for flying. Both function in the same way: air currents pushing against the flat surface of the wings provides lift, and flapping the wings provides forward thrust. Yet the internal structure of a bird's wing is very different from that of an insect's wing. The bird's wing consists of flesh, supplied with food and oxygen by a network of blood vessels. Its support is on the inside, in its bones. The insect's wing, on the other hand, has no bones or blood vessels. It consists of a thin membrane stretched tightly around a network of wiry structures, similar to a kite.

The two terms - homology & analogy don't fall out on the structure/function axis ✗? Panda's thumbs, for example

Which is relevant for classification--similarity in function or similarity in structure? The first great taxonomist, Linnaeus, faced this problem and chose the latter: he classified the flying insects with other insects and not with birds, which seems quite right to us as well. Similarity in structure he referred to as homology. Similarity in function he referred to as analogy.

Yet the distinction between homology and analogy is not always easy to draw. Early in his career, Linnaeus mistakenly classed the Cetaceans (whales) as fish, not realizing that their fish-like shape was not a homologous but an analogous resemblance. Indeed, in the history of taxonomy, over and over again structures of astonishing similarity that were at first thought to be homologous were later found to be merely analogous.

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The giant panda is an eloquent illustration of the problem. The giant panda is native to the bamboo/alpine forests of southwest China. So is the lesser panda, or red panda. For over a century, scientists studying the two pandas have been unable to agree on whether they are members of the bear family or of the raccoon family. Since the first attempt to classify them in 1869, more than 40 major scientific studies have been published on the subject. About half of the studies concluded that the pandas were bears; half concluded they were raccoons.

undercuts interest in main text presentation?

In 1964, Dwight Davis, Curator of Vertebrate Anatomy at the Chicago Natural History Museum, published what has since been accepted as the definitive interpretation. Davis concluded that the giant panda was a bear, but the red panda was a raccoon.

Here is a classic case of scientists' being unable to decide which similarities to treat as decisive. Until Davis, scientists were unanimous at least on one point: that the two pandas were close relatives and should be classified in the same family. After all, there are compelling similarities between the two animals. In skeletal structure, their snouts, or muzzles, are similar in shape, as are their jaw bones. There are likewise several similarities in their internal organs that tie the two pandas together and set them off from bears. Genetically, the giant panda has only 42 chromosomes, far closer to the red panda count of 36 than to the 74 chromosomes of most bears. Moreover, unlike most bears, the giant panda does not hibernate. Neither

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results obtained from experiments are: ape--62 percent of the precipitation caused by human blood; monkey--22 percent; cat--6 percent; chicken--0 percent.

What this test tells us is that animals similar in skeletal structure (e.g., apes and humans) may be similar in blood chemistry as well. But the results are not always so neat.

Another technique recently developed is protein mapping. Researchers can now employ high-technology equipment (the protein sequence analyzer) to map the amino acid sequences of proteins. By comparing the sequences of a particular protein, such as cytochrome c, taxonomists can map similarities between different animals. Cytochrome c is composed of a string of one hundred and four amino acids. Theoretically, animals with a greater number of differences in amino acids will be those classed farther apart taxonomically.

In some cases, our theoretical expectations are borne out, and organisms with similar skeletal structures also exhibit ~~a low number of~~ fewer differences in protein structures. For instance, in humans and monkeys, the sequence of amino acids in cytochrome c is identical except for one amino acid. In other cases, however, similarities on the macro level fail to match up with similarities on the micro level. For instance, turtles have less in common with another reptile, snakes, than with birds. Chickens have less in common with ducks than with penguins. Similarly, analysis of the amino acids in hemoglobin, another

terms not introduced generally, or in comparisons of a couple of proteins?

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protein, shows that crocodiles have less in common with snakes than with chickens. ((give more examples))

What do we learn from blood and protein analysis? The pattern of similarities and differences revealed by such procedures often contradicts the patterns revealed by anatomy and behavior. Sometimes animals that are similar in overall appearance are also similar on a molecular level. Sometimes they are not. Resemblances form a sort of patchwork pattern. Now let's see how evolutionists and creationists explain that pattern.

To be fair, we must acknowledge that a disproportionate # of cases go the evolutionists way, however

FAMILY RESEMBLANCE

good for use at top of discussion (p.1)

For Darwin, similarity was the major argument for evolution. Similarity is interpreted as "family resemblance": two organisms are similar because they are descendants from a common ancestor. Imagine a photograph of a large extended family. The family features are obvious; moreover, brothers and sisters resemble one another most closely, cousins somewhat less, and so on. In a comparable way, say evolutionists, degrees of similarity reveal how closely related organisms are.

For instance, the fact that all vertebrates are built on a common body plan means that they descended from a common ancestor, which evolved that body plan originally. Differences among vertebrates reveal how the basic plan has been adapted in each species under the pressure of natural selection.

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Yet, as we have seen, similarities are not always easy to discern nor to interpret. A given animal may resemble one group in certain features and another group in other features (as in the case of marsupials) requiring scientists to select which similarity to use in classification. In short, they must distinguish between homology and analogy. If the former indicates descent from a common ancestor, what does the latter indicate? According to evolutionary theory, similar features that are not inherited from a common ancestor result from **convergent evolution**, parallel adaptations to a similar environment. The Tasmanian wolf, for example, developed a skeletal structure nearly identical to that of the Canadian wolf because of genetic responses to a similar environment.

why withhold this term til 5 pages after analogy?

Unfortunately, the very term "homology" has been redefined to include the concept of evolution. Most biology books today define homology as correspondence of structure derived from a common ancestor. As a result, evolutionists sometimes fall unwittingly into a circular argument: the concept of evolutionary descent is employed to explain similar structures, and then the existence of similar structures is cited as evidence that evolution has occurred.

The argument from similarity has achieved even greater ~~prominence~~ today than in Darwin's day. Why? Because of the gaps in the fossil record. Because scientists no longer hope to trace a line of descent in the fossils from one organism to another,

prominence or importance?

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confusing since we're in the discussion centering on biological analogy.

By analogy, think of the many things that can be classified that are **not** derived from a common ancestor--things like cars and paintings and carpenter's tools. In short, human artifacts. What makes all Fords look similar, or all Rembrandts, or all screwdrivers, is that they are derived from a common design or pattern in the mind of the person making them.

If not exaggeration re: critics, consider using Nova-"small vocab. of shapes" here

Critics argue that if an intelligent agent created life, each major life form should be completely different from all others--the assumption being that the creative agent began from scratch in making each new design. But that assumption is ~~an~~ unwarranted. In our own experience we know that when people create things--whether car engines or computers--they begin with one basic design and adapt it to different ends. As much as possible, designers try to piggyback on existing designs instead of starting from scratch. Our experience of how human minds work provides an analogy to how a primeval, creator mind probably worked.

A Living Mosaic

Since both creation and evolution can logically account for similarities, the sheer existence of similarities cannot count as evidence against either theory. And yet, argue creationists, the erratic, patchwork pattern of similarities can be better accounted for by creation.

Recall the puzzle of the marsupials. According to evolutionary theory, the pattern for wolves, cats, squirrels,

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ground hogs, anteaters, moles, and mice each evolved twice: once in placental mammals and again, totally independently, in marsupials. This amounts to the astonishing claim that a random, undirected process of mutation somehow hit upon identical features several times in widely separated organisms.

Or take the problem of flight. The ability to fly requires a tremendously complex set of adaptations, affecting virtually every organ of the body. Yet evolutionists insist that flight has evolved independently not once but four times: in birds, in insects, in mammals (bats), and in reptiles (flying dinosaurs).

30-40 genes (had to be mutated into a highly coord. cluster to fashion fruit fly wing - Ambrose

Finally, consider the case of hemoglobin. Hemoglobin is the protein that carries oxygen in red blood cells. It is considered a homologous feature in nearly all vertebrates. Yet it can also be found in invertebrates: in some annelids (the earthworm group), some echinoderms (the starfish group), some mollusks (the clam group), some arthropods (the insect group), and in some bacteria. Hemoglobin even appears in the root nodules of peas. In all these cases, it is the same molecule that we find in vertebrates--complete and fully functional. If hemoglobin evolved, we ought to be able to trace some line of descent here. But that turns out to be impossible. As one scientist admits, "It is hard to see a common line of descent snaking in so unsystematic a way through so many different phyla."

who? source?

Logically, the evolutionist might conclude that the existence of hemoglobin in these widely different groups is not due to evolutionary descent after all--that the molecule is not a

Do they (evolutionists) not have a sufficient explanation of "molecular stasis"? Isn't selection pressure sufficient?

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homology but an analogy. But then he must say it evolved independently each time. That seems equally difficult to swallow. Parallel evolution might have sounded like a plausible explanation some decades ago when hemoglobin was thought to be a relatively simple structure. But we now know that hemoglobin is one of the largest and most complex molecules in nature, a web of about a hundred atoms arranged about a central iron atom. It does not seem possible that the entire eight-helix, twisted, exact, three-dimensional sculpture could appear repeatedly by chance mutations.

many times

Do you mean amino acids?

Spatial, precision of inter-molecular forces

What all these examples reveal is that similarities do not trace a simple branching pattern suggestive of evolutionary descent. Instead, they occur in a complex mosaic or modular pattern. As creationist Gary Parker puts it, similarities like the hemoglobin molecule appear here and there in the mural of living things like a blue-colored tile in an artist's mosaic. ((Henry Morris and Gary Parker, **What Is Creation Science?** (San Diego: Creation-Life Publishers, 1982), 24.))

Don't want to quote Parker, Morris

Not sure these terms convey the picture we want

Using different imagery, Michael Pitman describes similarities as fixed patterns or discrete blocks that can be assembled in various patterns, not unlike subroutines in a computer program. Genetic programs each incorporate a different permutation of these subroutines, generating the diversity of biological forms we see today.

This may be the best imagery to use - but must be "unfolded more slowly"

To use another analogy, similarities among living things are like pre-assembled units that can be plugged into a complex

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electronics circuit. They can be varied according to an organism's need to perform particular functions in air or water or on land. Pitman concludes: "Organisms are mosaics made up from such units at each biological level, and nothing of ancestry can be deduced from their possession." ((Michael Pitman, **Adam and Evolution** (London: Rider, 1984), 38-41. These illustrations from ~~Parker~~ and Pitman are good. Can we use them?))

no yes

True Homology

Of course, we are talking here about macroevolution, not microevolution. The latter refers to small-scale variation and diversification, analogous to what breeders and farmers do when they breed for fatter cattle or sweeter apples. All domestic cattle were probably derived from one or a few initial wild forms. Likewise with apples. In these cases, the presence of similarities is indeed a clue to relationship. Here, in short, is true homology. ((Have we actually used the terms macro- and micro-evolution before? In our initial definition of creation we should have introduced these terms, or at least the distinction between large-scale change and minor variation.))

The principle suggested by breeding is this: when we can establish on other grounds (e.g., historical grounds) that a group of organisms is related, then we may use homology to determine relationships within that group. For example, creationist Wayne Frair has used protein comparison techniques to determine the precise classification of the leatherback turtle

How does Frair's work employ a historical basis for relating groups?

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within the family of sea turtles. Creationist theory does not preclude all change; it merely denies the large-scale changes required by evolution, changes exceeding anything actually observed either in nature or in controlled experiments. In short, homology may play a restricted role in classifying variations within type but it is not conclusively evidence of evolutionary descent of one type from another.

it exceeding ?

SIDEBAR:

Paint and Ink

Evolutionists often cite findings of similarity in biochemistry as powerful, new confirmation of common ancestry. It was indeed impressive when scientists first discovered that all living cells contain ~~the same~~ DNA, composed of the same sugars and bases, and ~~the same~~ protein, composed of the same twenty amino acids. Clearly, organisms differ from one another much less at the cellular level than at the anatomical level. But what does this biochemical similarity mean? That all living things are related by descent from one original cell? To the creationist, it means merely that we have got down to the "raw materials" from which all living things were created.

under-states their case

The discovery that proteins are the basic building blocks of all living things generated great excitement. But would there be such excitement if we were to analyze Fords and Chevys and discover that they were constructed of the same kind of steel? Or that the paints used by Rembrandt and by Picasso were composed

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of the same chemical elements? Would these facts tell us anything about where the cars or the paintings came from?

was it? function completes the logic of this analogy

Likewise, the discovery that DNA is the molecule of heredity in all living things was hailed as compelling new evidence for evolution. But would there be any such excitement if we were to discover that all the books in the Library of Congress were composed of chemically identical paper and ink? Would we construct from that fact a theory on the origin of the books?

The theory of intelligent design does not mean each new living type must be produced out of thin air, entirely different from all other types. Indeed, if there were such wide variation in living things, food chains would be impossible and our present-day ecology could not exist. A universe made up of mutually dependent parts places considerable restraints on what variations are possible. The similarities we see at the biochemical level reflect the constraints of the starting materials and of the environment in which all living things must survive.

overstated - food chains would require more energy spent in gaining energy

True? support?

Tends to make strong assertions of general nature, for instance, rather than giving #s, like, the #s are necessary. Ambrose does. Afraid the #s are necessary to take enough to buy the conclusions otherwise. Most teachers will not be up to

Chapter 5: WHERE DO LIVING THINGS COME FROM?

Open any book on evolution and you will see photographs of light- and dark-colored moths, finches with different-sized beaks, varieties of roses, and races of human beings. Here before your eyes is evolution is action, says the text. Here is empirical proof that evolution occurs.

something's missing not sure what

But wait--the moths are still moths, the finches still finches, the roses still roses, the human beings still human. This is not evolution but merely diversification within type, says the creationist. Changes **within** type are not the origin of **new** types.

How do new types of living things arise? To answer that question we turn to the source of change within organisms--to genetics. What are the basic facts of genetics relevant to origins questions?

Fact #1. Most variations are produced by recombination of existing genes. The tremendous differences that divide a Pekinese, a Poodle, and a Greyhound illustrate the range of variation that may exist within a single gene pool. These variations are produced when dog breeders isolate particular genes governing size, curly hair, or speed within a single breed. The genes can be combined and recombined in a vast number of different ways. Most changes in the living world are produced in this way--not by the introduction of anything new into the gene pool but by simple recombination of existing genes.

defined?

Recombination may produce interesting and useful varieties, but it takes its toll upon the animal in terms of strength and survivability. Highly bred animals are weaker, more prone to disease, and less fertile. In fact, if bred too far, the animal simply becomes infertile and dies out. There is a limit to how far animals can be bred from their original form.

Fact #2. The only known means of introducing genuinely new features into the gene pool is by **mutation**, a change in the DNA structure. **Gene mutations** occur when individual genes are damaged from exposure to heat, chemicals, or radiation. **Chromosome mutations** occur when sections of the DNA are duplicated, inverted, lost, or moved to another place in the DNA molecule.

Mutations are quite rare. This is fortunate, for they are in virtually all instances harmful. Recall that the DNA molecule is like a message. A mutation is a random change in the message, akin to a typing error. Typing errors rarely improve the quality of a written message; if too many occur, they may even destroy the information contained in it. By the same token, mutations rarely improve the quality of the DNA code; too many may even be lethal.

EVOLUTION: NEW TRAITS FROM OLD

Behold the giraffe: Oversized limbs, stretched-out neck, ungainly posture---everything apparently precariously out of proportion. And yet its parts are marvelously coordinated to

each other; it moves with graceful ease and delivers such a powerful kick that it has no natural enemies.

The outlandish body shape of the giraffe has been a puzzle to evolutionists since before the time of Darwin. Jean Baptiste de Lamarck, one of Darwin's predecessors, suggested that the giraffe's long neck resulted from its constant stretching upward to reach leaves to eat. Bone structure changed in response to the animal's need to reach ever higher. But scientists now know that body structure does not respond to the organism's needs or habits. If it did, Olympic racers should give birth to yet faster racers, and centuries of shaving should yield men without whiskers.

Darwin's theory of natural selection turned Lamarck's explanation around: instead of the environment giving rise to habits, which in turn produce new traits, Darwin maintained that something within the organism itself gives rise to new traits, which are either preserved or weeded out by the environment. In place of an organism needing a longer neck to survive, Darwin put an environment favoring organisms with longer necks, and then preserving any that happened along--the giraffe, as it turned out.

This is not correct & is almost totally dismantled in 7 lines (*)

Clearly, the crux of Darwin's theory was to find that "something" within the organism that is the source of new traits. To maintain that organisms either survive or perish depending on whether they are well suited to the environment was no new insight. What was unique about Darwin's theory was his idea that

some force within organisms could throw out new traits--traits that over time would produce an entirely novel sort of organism.

★

What force could this be? Darwin himself did not know. But ironically, at the same time Darwin was constructing his theory, an Austrian monk named Gregor Mendel was conducting experiments to answer just that question. Mendel discovered that traits could be lost in one generation only to reappear in a later generation. This meant, he concluded, that heredity was governed by particles (later called genes) passed on from parent to offspring. A trait might be lost temporarily, but the gene that gave rise to ~~coded for~~ that trait remained present within the organism and would be passed on to its offspring.

Was it evident then?

If Darwin had read Mendel's papers, he may never have published his own theory. For the gist of Mendel's work was that living things are remarkably stable. When a breeder, for example, causes some characteristics to appear or disappear, this represents neither a true loss nor a true gain. It represents merely the interplay of dominant and recessive genes. A trait "lost" is present still and will reappear. A "new" trait that seems to appear out of nowhere is not new at all but simply the expression of a recessive gene that existed all along. When breeders produce new show dogs or fatter cattle, they shuffle genes around and bring some of these recessive genes to expression.

bean bag vs. clusters (see p. 5 to)

not ! for !

In short, Mendel showed living things are remarkably stable. His discovery fit neatly with the theory of intelligent design--

It did?

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It did, clearly?

the theory that each type of living thing was created with a limited pool of possible variations. But it clearly contradicted evolutionary theories (which may be why for decades Mendel's work was ignored). Evolution assumes that living things are constantly developing new traits--that from its beginning in a pool of chemicals, life is ever evolving new and varied structures.

Mendel's theory was not taken seriously until the first decade of the twentieth century, when evolutionists realized they had something to gain from it. Up to this point, the most commonly held concept of inheritance was a "paint-pot" model--the father's contribution mixed with the mother's the way blue and red combine to form purple. If paint-pot model were correct, then any new trait that might evolve would be lost, just as the original blue and red colors are lost. In Mendel's "bean-bag" model, by contrast, genes act separately and are inherited essentially unchanged. Mendelian genetics appeared to make evolution possible by explaining why a single new advantageous genetic trait could survive and become dominant in a population.

Mendelian genetics, then, has proved to be a mixed blessing for evolutionary theory. On the one hand, it provides the stability necessary for a trait to become established in a population. On the other hand, stability is just what evolution doesn't need if change is to be so far-ranging as to produce the whole complex web of life from a single one-celled organism.

CHAPTER 5

Does Nature Select?

Darwin himself was a breeder,

Darwin was impressed by the work of breeders, and with good reason. By selecting animals with particular traits and allowing them to reproduce, breeders were able to create greater differences **within** species than often exist **between** species in the wild. Could not nature do the same and much more, Darwin asked, given enough time?

It is obvious that, in nature, many more young are born than survive. It happens that at times, through recombination of existing genes and through mutation, some young may acquire a new trait not present in their peers. If the new trait renders these youngsters better suited to the ecological niche they inhabit, they have a better chance of surviving and passing the trait along to offspring. If they are lucky enough to survive, and if their succeeding generations are likewise lucky, eventually animals that possess that particular trait will come to outnumber those who do not. The trait has become established.

Too easy

Darwin dubbed this process natural selection, to emphasize its parallels to what breeders do when they select for given traits. Unfortunately, the term implied that nature was capable of actually "selecting"--of foreseeing what is needed, of choosing appropriate traits, of guiding and directing the process of evolution. Of course, nature can do none of these. The term natural selection simply refers to the interplay between organism and environment that allows new traits to become established within a population.

N.S. should be shown as conservative force

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N.D. Synthesis

Darwin's classic theory of natural selection was eventually refined to include Mendelian genetics and our current knowledge of mutations. But Neo-Darwinism is under attack today, and not just from creationists. Within the evolutionist camp itself, criticism has erupted.

not really

The Wrong Kind of Change

The volley against Neo-Darwinism was delivered by both paleontologists and geneticists. On the one hand, paleontologists finally resigned themselves to the reality of gaps in the fossil record; as a result, they have reluctantly rejected Darwin's schema of evolution by a steady accumulation of minor changes (see Chapter Two). On the other hand, geneticists have spent the last several decades studying genes and mutations; they have concluded that the changes observed do not constitute the **kind** of change required by evolution.

They have? The kind of change required by which kind of evol?

Scientists sometimes give the impression that any change is evidence for evolution. But evolution is not just any change. It is a very special kind--the transformation of one type of organism into another. If you picture in your mind an evolutionary tree, the change produced by breeders is horizontal change, the flowering and elaboration of a single branch. This is diversification within type, sometimes called micro-evolution. What is needed, however, is vertical change, leading up the evolutionary tree. This is the origin of new types, sometimes called macro-evolution.

within a given level of complxty

This speaks for the whole science

Neo-Darwinism assumes that micro-evolution leads to macro-evolution. To put that into English, it assumes that small-scale changes will accumulate and lead to large-scale changes. But half a century of experiments with genes and mutations has led geneticists to reject that assumption. The changes observed in the laboratory and the breeding pen are all limited, all micro; they do not accumulate the way the theory requires in order to produce macro changes. The process that produces macro-evolutionary changes must be different from any that geneticists have studied so far.

But suggestions are put forth

What is that process? No one knows. At present there is no accepted genetic theory to replace Neo-Darwinism. Evolutionists are in the uncomfortable position of being unable to present a mechanism to explain how living things evolve. They continue to be committed to the belief that evolution occurs but are uncertain how it occurs.

INTELLIGENT DESIGN: PACKAGE DEAL

Why bring D. up?

Too short to make the point yet

The giraffe's long neck may appear ungainly, but it is actually an integral part of the animal's overall structure. Darwin supposed the giraffe's long neck was necessary to reach foliage high in the trees. That may be true, but the fact is that the giraffe also bends its heads down to the ground to eat grass and drink water. Given the giraffe's long legs, its neck may just as well be required to reach the ground as the trees. In short, the giraffe ~~is~~ has an adaptational package in which each

save til "single schema" ¶

part is suited to the others. Trying to explain which one came first is like trying to explain which came first, the chicken or the egg.

~~There is more.~~ The giraffe requires a very special circulatory system. When standing upright, its blood pressure must be extremely high to force blood up its long neck, which in turn requires a very strong heart. But when the giraffe lowers its neck to eat or drink, the blood rushes to its head and it faces a potentially dangerous situation: its high blood pressure together with the weight of the blood in the neck could produce such a high pressure in the head that the blood vessels would burst.

To counter this effect, the giraffe is equipped with a coordinated system of blood pressure controls: Pressure sensors along the neck's arteries monitor the blood pressure and activate contraction of the artery walls to counter the increase in pressure.

yes? Rete M. too

In short, the giraffe represents not a mere collection of individual traits but a package of interrelated adaptations. It is put together according to an overall "Bauplan," or design, that integrates all parts into a single schema. Where did such a schema come from? ?

The evolutionist says the giraffe evolved to its present form by an accumulation of individual, random changes preserved by natural selection. But it is difficult to see how a random process could produce an integrated package of adaptations.

FTE001340

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Ambrose discussion of sheep here, or in main chap?

Random mutations might adequately explain change in a relatively isolated trait, such as color. But major changes, like the evolution of the giraffe from some other animal, would require an entire series of co-ordinated adaptations. The complex circulatory system of the giraffe must appear at the same time as its long neck or the animal will not survive. An overall integrated design must be present from the beginning.

No sense of proportion conveyed. High specificity. "tinker" "minor" better needs to be addressed more quantitatively (can happen, but don't build a theory out of it)

To explain the appearance of new body types, we need a mechanism capable of generating not detailed change but **systemic** change (affecting an organism's general physical structure). As an analogy, suppose you are a plumber by education and trade. Experience can teach you quite a bit about how to be a better plumber. But experience as a plumber cannot teach you how to be an electrician. No amount of refining of your plumbing skills will change you into an electrician. Instead, you must start all over again learning the new subject area. Likewise, minor changes caused by recombination of genes and by mutation are acted upon by natural selection to refine an organism, enabling it to fit better within its ecological niche. But no amount of refining of its current body plan will produce a new body plan.

The 2 kinds of change must be more convincingly distinguished (as by Ambrose) or this gives away the ballgame

upward? More info?

In creating a new organism, as in building a new house, the blueprint comes first. We cannot build a palace by tinkering with a tool shed and adding bits of marble here and there. We have to begin by devising a plan for the palace; then all the parts will be coordinated into an integrated schema.

The analogy is good, but only after the case has been persuasively made

Evolution locates the origin of new organisms in material causes, the accumulation of individual traits. That is akin to saying the origin of a palace is in the bits of marble added to the tool shed. Intelligent design, by contrast, locates the origin of new organisms in an immaterial cause: in a blueprint, a plan, a pattern, devised by an intelligent agent.

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Chapter 6: The Origin of Species

The creation/evolution controversy is very complex, involving arguments from biology, genetics, geology, paleontology, embryology, and comparative anatomy. The ordinary person is hard-pressed to grasp it all.

Yet, the core of the controversy is relatively simple: It is the question whether change in living things is limited or unlimited. Darwin believed change is unlimited, that species are infinitely plastic. He thought a species could vary indefinitely and in any direction. Yet all changes scientists have actually observed--in breeding experiments, for example--are limited. Breeders have created all sorts of interesting varieties of cats and horses and roosters, but the new animals are still cats and horses and roosters.

Yet evolutionists argue that the mechanism for unlimited change lies in **speciation** (the origin of new species). Darwin was certain that the mechanism for the rise of new species would also be the mechanism for the rest of evolution. If a new species can arise, then the same process continued further should give rise to a new genus, then a new family, order, class, and phylum.

Is speciation the door to unlimited evolutionary change? What do scientists know, a hundred and thirty years after Darwin, about speciation?

Didn't we say earlier (a point unfamiliar to me) that Darwin rejected the notion of species for a continuum of individuals? Does this appear to conflict w/ Chap. 3+4, p. 2?

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Fact #1. The rise of new species depends on what we mean by the word "species."

A species is generally defined as a interbreeding population. Therefore, a new species is produced when a group splits off from its parent population and no longer interbreeds with it.

capable of ongoing propagation (Check∴) See p.4 breeding chain

This might happen when some physical barrier cuts the group off from its parent group. For example, birds might be blown by storms onto an island that is too far from the mainland for them to fly back (which apparently happened to the finches that now inhabit the Galapagos Islands). Or animals may cross to a new continent by a land bridge that later erodes away.

Once physically isolated, the two groups may change in different directions. They may accumulate a different set of mutations. Each is also subject to **genetic drift**, which means that the frequency of certain genes may change. Eventually the two groups may not be able to interbreed any more, even if they are brought back into contact with each other.

But Hardy-Weinberg principle

Fact #2. Speciation is more likely to occur in smaller populations.

The effects of mutation and genetic drift are much more dramatic in small populations. Because members of a small group are forced to interbreed very closely, a mutation could become widespread very quickly. Genetic drift is more pronounced because the laws of genetics are statistical. When a black

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Fact #4. Speciation may occur when a breeding chain is broken.

A **breeding chain** is not unlike what we see in dogs. A Chihuahua may not breed with a Great Dane because of sheer size, but it will breed with other dogs closer to its size. These dogs in turn will breed with other dogs slightly larger in size, until finally we reach the Great Dane. In other words, though the two extremes cannot interbreed, there are intermediate breeds connecting them. Therefore all dogs are considered a single species.

Such a breeding chain may exist in nature as well. A classic example is a species of fruit fly living in the Amazonian and Central American rain forests. These forests originally covered an immense area, the size of the European continent. At one time, a single species of fruit fly had a continuous distribution over the entire vast domain. Recent studies, however, have found that subpopulations now exist within the species. Adjacent subpopulations can interbreed with each other but those at the opposite edges of the rain forest cannot interbreed with each other.

This is happening in the Amazon now

What would happen if the intermediate links disappeared? If some environmental event, say the development of a great plain, cut the rain forest in two, the intermediate links would die out. The extreme subpopulations would now be considered separate species, although at one time they were part of the same species.

WHAT SPECIES OF SPECIES?

Darwin presumed that if he proved the origin of new species, he had proved evolution. Hence the title of his book on evolution, The Origin of Species. But he was working with an entirely different definition of species from the modern one.

The ancient Greek philosopher and biologist Aristotle taught that species are eternal and unchanging. For him, a species was a generalized Form of Cat or Sparrow or Whale, of which all particular cats and sparrows and whales were representatives. Aristotle believed matter was evil and constantly resisted the pattern imposed on it by the ideal Forms; this was the source of individual variations.

The Christians of the Middle Ages rejected Aristotle's view (they held that...) that species are eternal (only God is eternal). But the influence of classical culture was so great that the medievals did not break completely with the Aristotelian approach to nature. And so Christians continued to hold that once created, species never change and never die out. With the discovery of other continents, they added the notion of creation in location: that the species of Africa were created there, the species of America created there, and so on.

This definition of species made it relatively easy for the early evolutionists to "refute" creation. All they had to do was to prove that many organisms once alive are now extinct (species don't last forever), that variation does occur (species are not

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unchanging), and that organisms often migrate (species were not created in their current locations).

Much of Darwin's book **Origin of Species**, for example, is taken up with just such arguments. Yet today such arguments would not be persuasive. Why not? Because the definition of species has changed. Modern creationists allow for extinction, variation, and migration. Today "the species question," as it is called, is simply whether there is a natural unit in the organic world beyond which change will not go. The evolutionist is committed to unlimited change. The creationist maintains that there is a natural unit that limits the kind of change that will take place in living things.

The Modern "Species"

pretty cozy w/Aristotle ?

Modern evolutionists are eager to get away from any hint of Aristotelian Forms or Archetypes. The most common definition of species today is an interbreeding population. A new species, then, is simply a race or variety that has become reproductively isolated from its parent population. But is this evolution?

Yes, says the evolutionist. Once reproductive isolation occurs, the road lies open to large evolutionary change. Each of the two separated populations will now continue to evolve further independently.

No, says the creationist. Speciation represents change, but not the right kind of change. Think again of the illustration of dogs. What if the intermediate-sized breeds somehow all died

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out, leaving only Chihuahuas and Great Danes? The species Dog would now consist of two reproductively isolated populations. But would we consider them separate species? Would we conclude that they now were capable of evolving into something other than dogs?

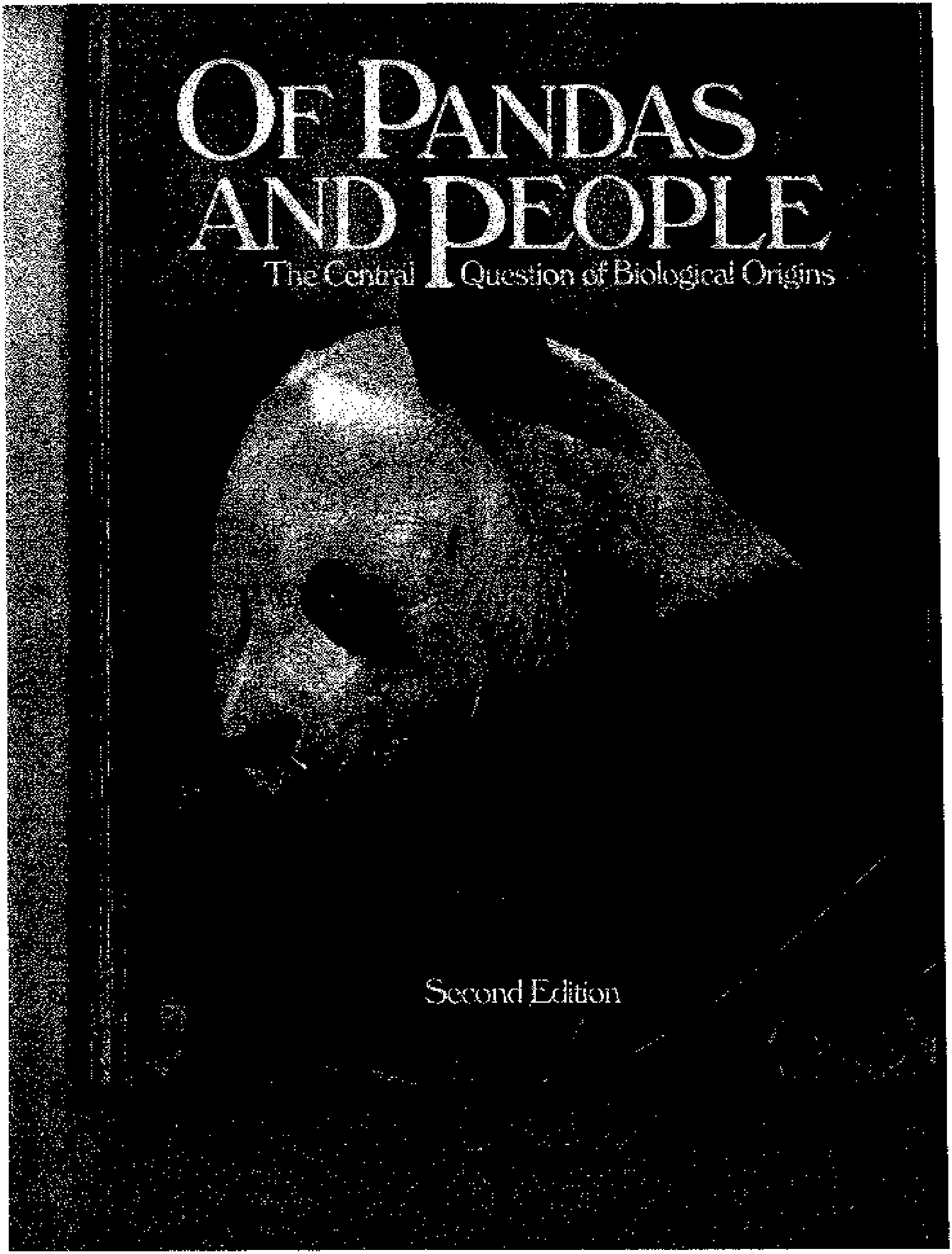
The appearance of reproductively isolated populations represents micro-evolution, not macro-evolution. It is one of the ways in which there can be diversification within type. As we put it earlier, it is a mechanism for the flowering of a branch in the evolutionary tree, not for going up the tree.

change w/in a level of complexity

Mechanisms of speciation all represent a loss of genetic information. Yet going up the evolutionary tree requires the creation of additional genetic information. To go from a one-celled organism to a human being means that information must be added to the genetic code. The founder effect and the bottleneck effect both create varieties by cutting a small population off from its parent population and building a new group from the more limited genetic information contained in that small population. Mechanisms for the loss of genetic information cannot be used as support for a theory requiring the gain of genetic information.

Speciation is actually much akin to what breeders do: They isolate a small group of plants or animals and force them to interbreed, cutting them off from the larger gene pool to which they belong. Centuries of breeding testifies to the fact that this produces limited change only. It does not produce the unlimited change required by evolution.

HEARING EXHIBIT 8


OF PANDAS AND PEOPLE
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Second Edition

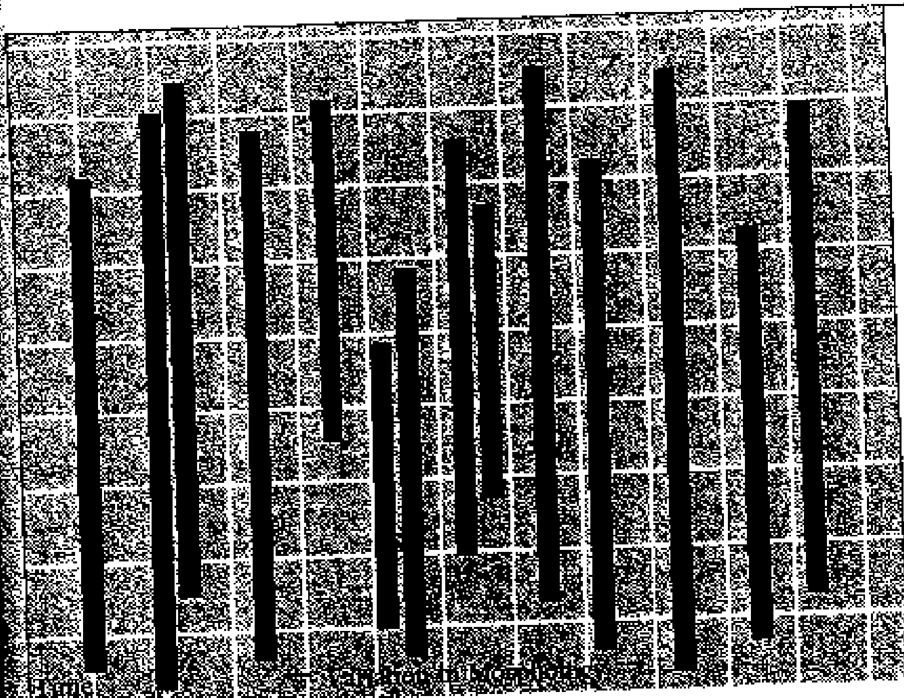

Figure 4-4. The pattern of phylogenetic origins, according to the face value interpretation of the fossil record.

alive today. Those that end before reaching the top represent extinct forms like *Archaeopteryx* (ar-kee-OP-tuh-rix) or the dinosaurs. The vertical lines do not converge at the bottom as they did in Figure 4-1. This indicates that as more fossils are being discovered, organisms within distinct groups, not transitional forms, are being found in older and older strata.

The intelligent design view is also consistent with Feature No. 2—the observation that some forms of life have undergone little or no change (by conventional reckoning) for tens or hundreds of millions of years. Some of these forms are still surviving today. Table 4-1 lists examples of some of these "living fossils."

Darwinists object to the view of intelligent design because it does not give a natural cause explanation of how the various forms of life started in the first place. Intelligent design means that various forms of life began abruptly through an

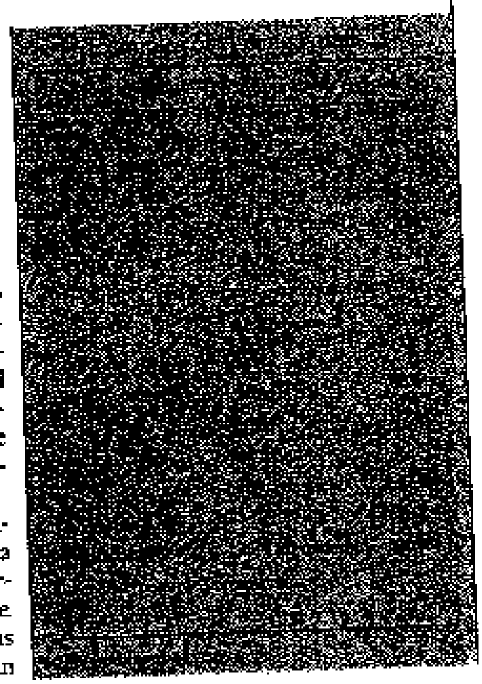

Table 4-1. *A sample of organisms remaining largely unchanged over vast periods of time.*

intelligent agency, with their distinctive features already intact—fish with fins and scales, birds with feathers, beaks, and wings, etc. Some scientists have arrived at this view since fossil forms first appear in the rock record with their distinctive features intact, and apparently fully functional, rather than gradually developing. No creatures with a partial wing or partial eye are known. Should we close our minds to the possibility that the various types of plants and animals were intelligently designed? This alternative suggests that a reasonable natural cause explanation for origins may never be found, and that intelligent design best fits the data.

Gaps and Groupings in the Fossil Record

Mammals

A most impressive example of transition to which Darwinists point is the series bridging from the reptiles to the mammals. This class-level transition is to have taken place through a group of mammal-like reptiles called Therapsids (thuh-RAP-sidz). Among the several Therapsid lineages were the dominant land-dwelling vertebrates from the middle of the Permian period to the middle Triassic. Indeed, it does appear that they provide Darwinists with a superior example of a transitional series. In 1987, evolutionary biologist James Hopson published an article describing a series of eight Therapsid skulls that made up a fairly well-filled-in sequence of intermediate types, apparently leading to the ninth, an early mammal named *Morganucodon* (mor-guh-NOO-kuh-don).[11]

Hopson detailed several characters exhibited by the series, characters that progress together toward the mammalian body plan. These include: 1. Change in the way the limbs are connected. 2. Increased mobility of the head. 3. Fusing of the palate. 4. Improved musculature of the jaw. 5. Migration of the articular and the quadrate bones from the back of the reptile's jaws toward the middle ear (where in the mammal they would be transformed into auditory ossicles). It is the simultaneous movement of several traits, says Hopson, that clearly infers that the Therapsids are a continuous lineage to the mammal. (Of course, fossils can't record the potentially vast differences in systems like the reproductive and circulatory systems, nor the organs, glands, and other soft tissues they entail.)

What Hopson actually presented, however, is a structural series, not a lineage. Although he predicts "that the series of mammal-like reptiles ordered on the basis of morphology will also form a series in geologic time,"[12] in actuality, the first three of Hopson's Therapsids are contemporaries from two separate orders, and some are not thought to be mammalian ancestors. Rather than older, the fourth is more recent than the fifth, and the final Therapsid is more recent than the mammal (Morganucodon) presented as its descendent!

It is legitimate to assemble a morphological series for the purpose of speculating about which skull is structurally intermediate to which others, but it is certainly not in the interest of education that it is presented as a single path of descent—an actual evolutionary lineage.

There are numerous fossil Therapsid species in the record. In fact, Douglas Futuyma said:

> The gradual transition from Therapsid reptiles to mammals is so abundantly documented by scores of species in every stage of transition that it is impossible to tell which Therapsid species were the actual ancestors of modern mammals.[13]

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